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**PROCEDURE FOR INSTALLING  
AN/USQ-11A TRANSPONDER SET  
IN KDA-4 TARGET**

By

**W. L. TIMMONS**  
Surface and Missile Targets Division

18 July 1963

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AN ACTIVITY OF THE BUREAU OF NAVAL WEAPONS

K. C. CHILDERS, JR., CAPT USN  
*Commander*

This report describes work accomplished under WEPTASK R-34UIS-003 (I), Development and Operation of Aerial Targets.

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*Technical Director*

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## **SUMMARY**

The AN/USQ-11A Transponder Set and its receiving and transmitting antennas can be installed on KDA-4 target aircraft when miss-distance information is required.

Special mounting brackets are made to attach the transponder set to the KDA-4 nacelle tray. The mounted transponder set is connected to a source of 28 volts DC.

The KDA-4 engine air inlet is modified so that the receiving antenna can be mounted on it. The transmitting antenna is mounted on the ignitor access door. Cables from the antennas are connected to the proper plugs on the AN/USQ-11A Transponder Set.

If called for by the over-all KDA-4 configuration, a compensation for the change in the center of gravity is then made.

## INTRODUCTION

The AN/USQ-11A Transponder Set manufactured by Interstate Electronics Company is the successor to the AN/USQ-11 Transponder manufactured by Aircraft Armaments Incorporated. The theory of operation of the two transponders is the same. However, since the packaging of the two transponders is different, it is necessary to describe the method of installing the more recently developed one.

The AN/USQ-11A Transponder Set, a unit of the AN/USQ-11A Miss Distance Measuring System, can be installed in KDA-4 target aircraft with the necessary antennas, when miss-distance information is required. The missile being fired at the target must have a telemetry transmitter or a low power (2 watts) VHF transmitter. The AN/USQ-11A Transponder Set receives the carrier from the missile and retransmits the signal at another frequency to the ground station, where it is recorded. Analysis of the recorded information provides miss-distance, the relative intercept velocity and the time of closest proximity of missile and target.

This report describes the appearance of the AN/USQ-11A Transponder Set, its antennas, and how to make the specially designed brackets needed to mount the transponder set. It also gives instructions for installing and connecting all the target-borne components of the miss-distance measuring system and for compensating for the resulting change in the center of gravity of the KDA-4 target.

## DESCRIPTION AND INSTALLATION OF AN/USQ-11A TRANSPONDER SET

The AN/USQ-11A Transponder Set is fastened to the KDA-4 nacelle tray by means of two sets of specially made mounting brackets. The following section consists of a brief description of the transponder set, instructions for making the mounting brackets, and the procedure to follow in mounting and connecting the transponder set to the external power source.

### Transponder Set

The AN/USQ-11A Transponder Set consists of an RF amplifier, a frequency converter, and a power supply, all mounted in a circular pressurized metal case 9 inches long and 6 inches in diameter (see background of figure 1). The total weight of the unit is 8 3/4 pounds.

The input end of the transponder set can be seen in figure 1. This end has three jacks, labelled as follows: SIGNAL INPUT J601A; TEST NO. 1 J602; POWER INPUT J605.

The opposite or output end of the transponder set has an air inlet valve and two jacks, labelled TEST NO. 2 J603 and SIGNAL OUT J604A.

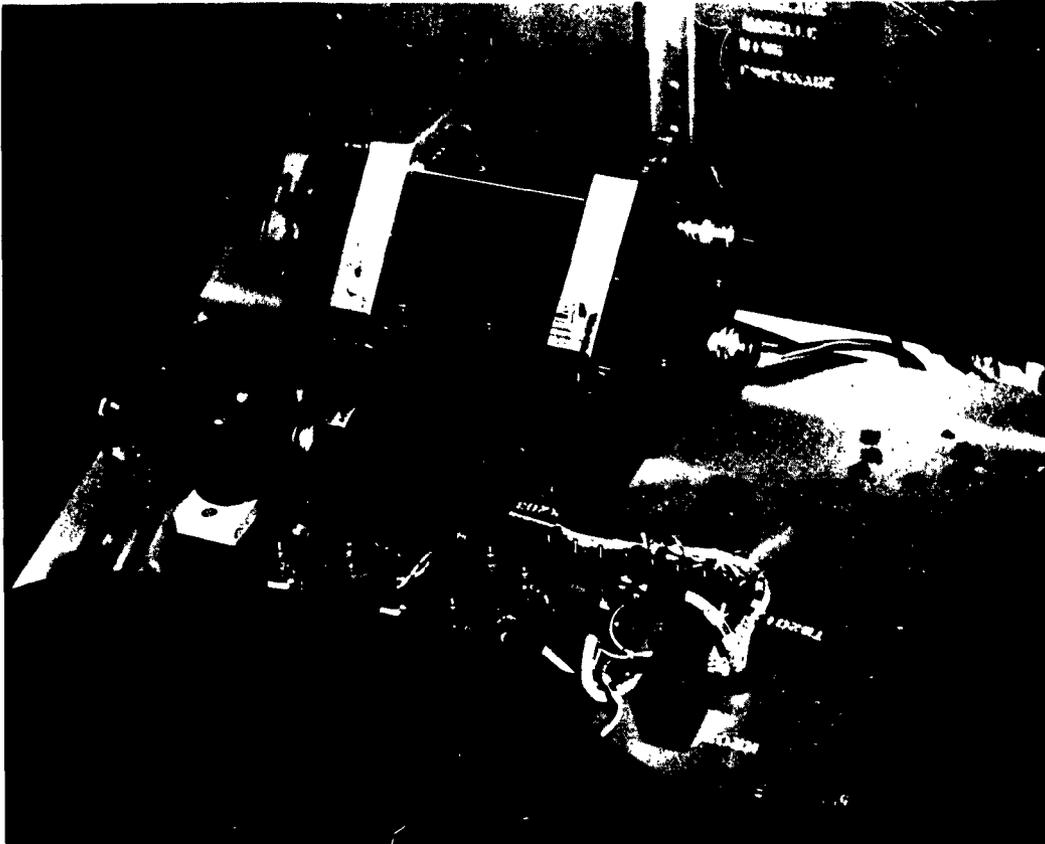


Figure 1. AN/USQ-11A Transponder Set, Mounted With Special Brackets on Nacelle Tray.

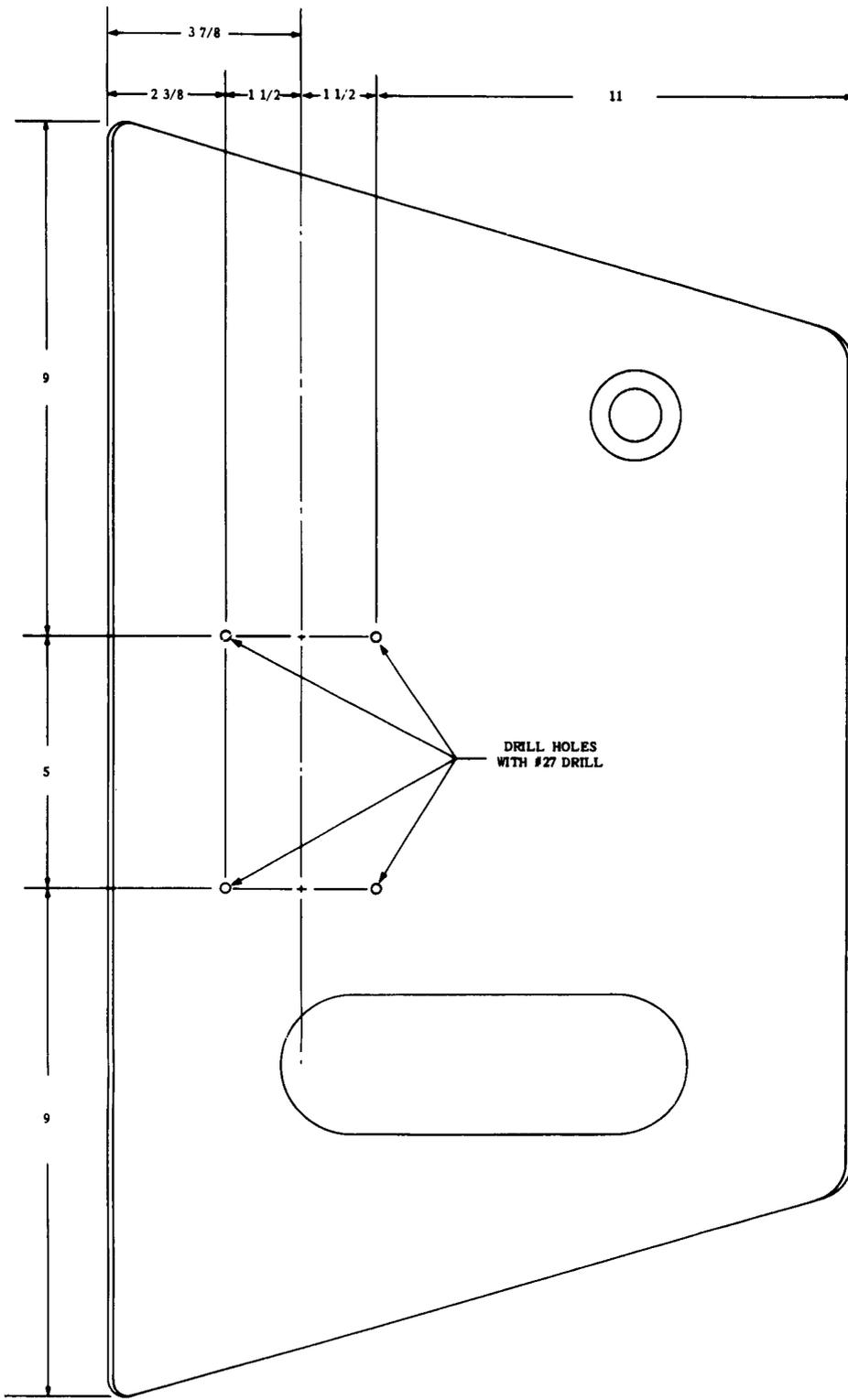
### Mounting Brackets

Prior to installing the transponder set in the KDA-4 target it is necessary to fabricate two sets of mounting brackets. Figure 2 is a working drawing of one set of mounting brackets, giving all the measurements and details needed to fabricate them.

### Installing Transponder Set

The transponder set is mounted on the existing KDA-4 nacelle tray. Four No. 27 holes are drilled through the nacelle tray to correspond with the points marked on figure 3. The two lower mounting brackets are fastened to the nacelle tray. The transponder set is then placed on the lower brackets in the orientation shown in figures 1 and 4, after which the upper brackets are lowered into position and fastened to the lower brackets with four screws so that the mounted transponder set appears as shown in these figures.





NOTE: DIMENSIONS ARE IN INCHES.

Figure 3. Nucleon Tray, Showing Position of Holes for Mounting Transponder Set.

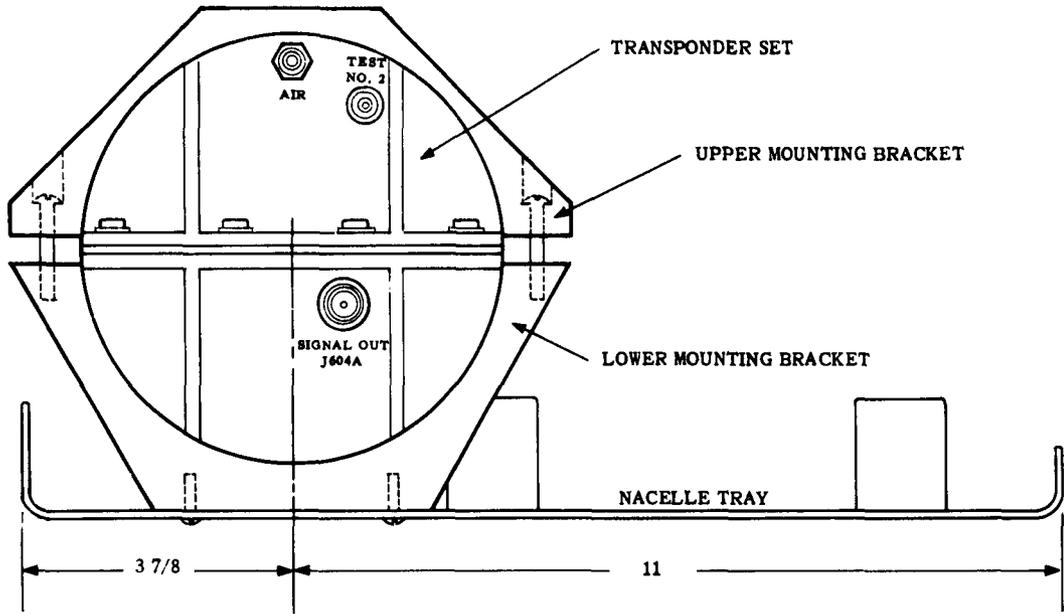


Figure 4. End View of Transponder Set, Fastened to Nacelle Tray With Mounting Brackets.

### Power Connection

The power connection is made so the AN/USQ-11A Transponder Set will receive  $28 \pm 2.8$  volts whenever power is applied to the KDA-4 target.

A power input plug (P605) is connected to the power input jack (J605) on the transponder set (see figure 5a). Figure 5b represents the conductor wires coming from the power input plug. Conductor wires A and C are connected to a wire leading to the ground terminal and conductor wire B is connected to the positive terminal of the 28-volt DC power source (see figure 5a). For normal operation, wire E is connected with a jumper to the wire going to the ground terminal. This jumper is removed prior to any flight not requiring USQ-11A equipment, placing the equipment in a standby status and applying power only to the heaters and the filament of V101.

### DESCRIPTION AND INSTALLATION OF RECEIVING ANTENNA

The receiving antenna is mounted on the upper side of the KDA-4 engine air inlet ("horsecollar"). The following section consists of a description of the antenna and a procedure for installing the antenna on the horsecollar and connecting it to the transponder set.

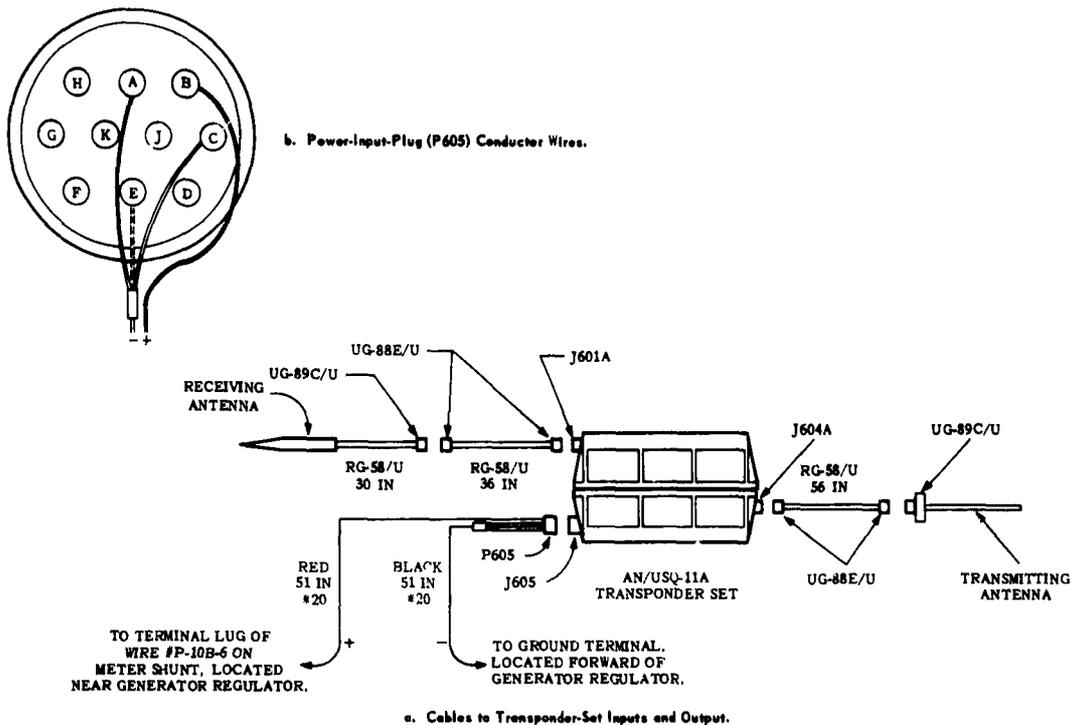


Figure 5. Wiring Diagram Showing Connections to Transponder Set.

### Receiving Antenna

The receiving antenna used is the model ADVT-1A sleeve type manufactured by Canoga Electronics or the model AT-85 manufactured by Aircraft Armaments Incorporated. This antenna has the following operating characteristics:

Frequency:	232 $\pm$ 5 Mc
Impedance:	50 ohms
Pattern:	Typical asymmetrical dipole
Material:	Nylon, aluminum, and epoxy fiberglass laminate
Waterproofing:	Epoxy coating

Figure 6 shows the receiving antenna as it appears after installation.

### Installing Receiving Antenna

Prior to installing the receiving antenna, enough fiberglass and styrofoam are removed from the upper portion of the leading edge of the horsecollar to allow the receiving antenna to be put in place (see figure 7). The existing nut plate, screws, and rivets, shown in detail in figure 8a, are removed from the underside of the horsecollar. The rivet holes are enlarged with a No. 10 drill. The antenna mount (see figures 7 and 8b), is then fastened to the horsecollar base with 10/32 nuts and bolts (see figures 7 and 8b). A 3/4-inch hole (see figure 8a)



Figure 6. Receiving Antenna Installed on KDA-4 Air Inlet Horsecollar.

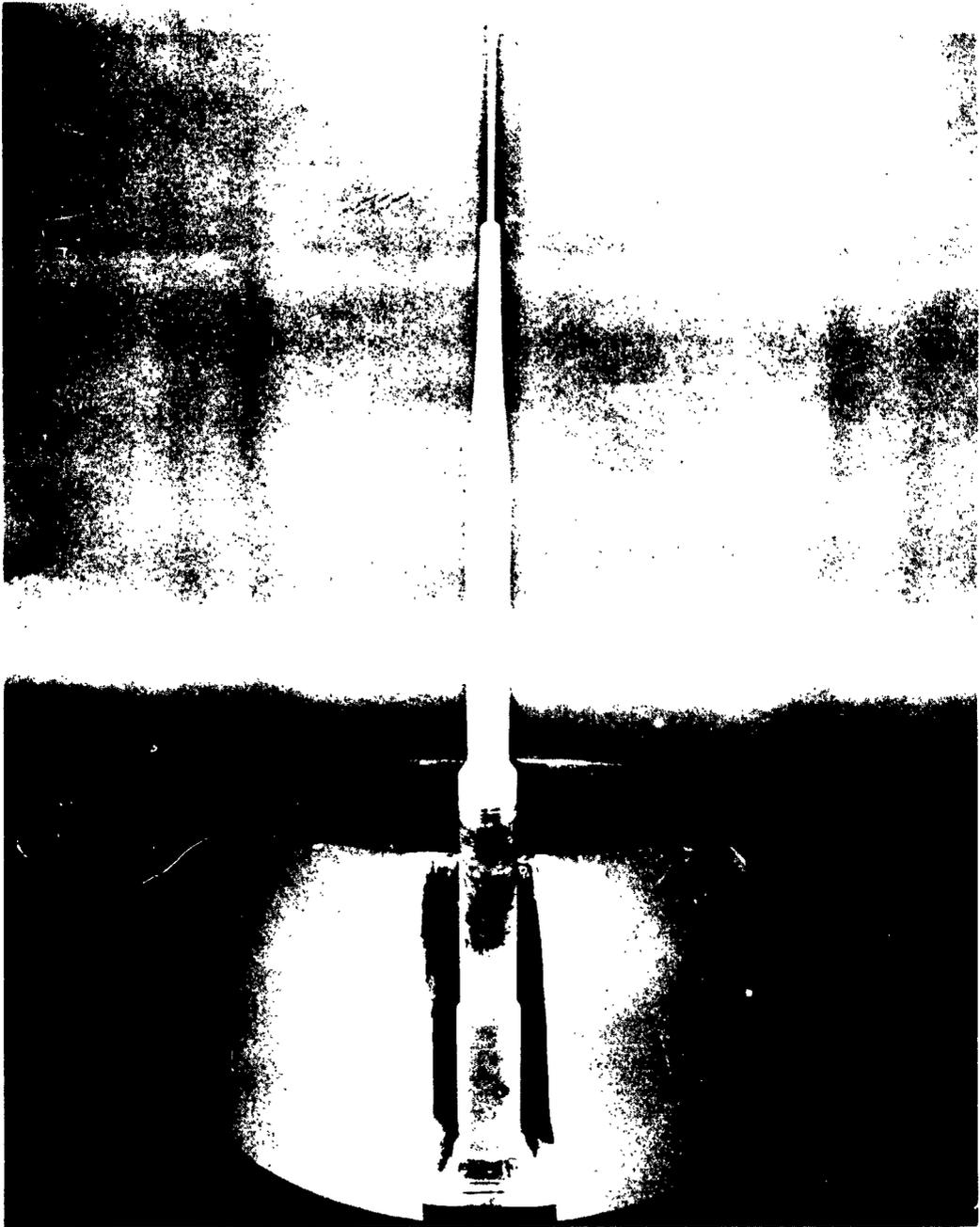
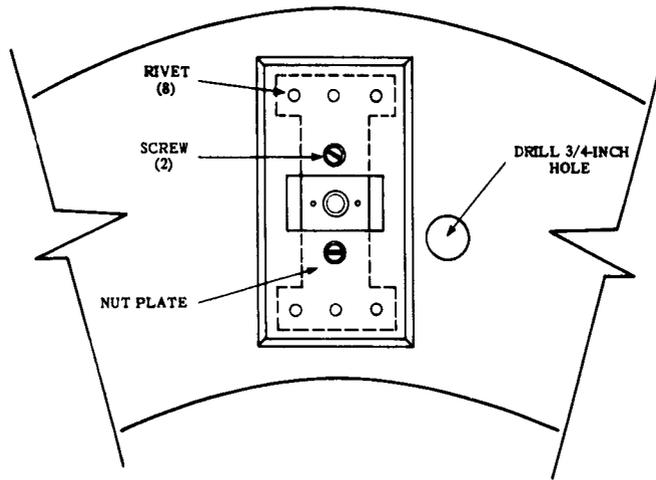
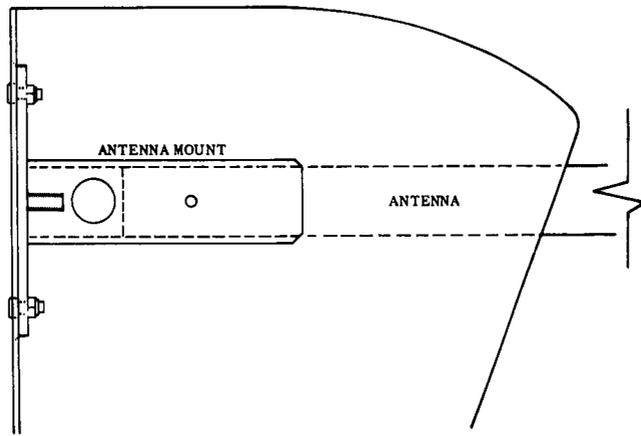


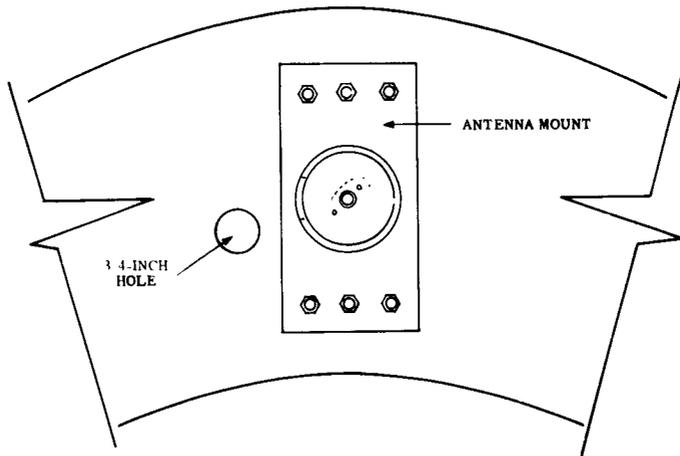
Figure 7. Air Inlet Horsecollar, During Installation of Receiving Antenna



a. Antenna Mounting Site on Underside of Air Inlet Horsecollar.



b. Antenna Mount Fastened to Horsecollar.



c. Top View of Antenna Mount Fastened to Horsecollar.

Figure 8. Installation of Receiving Antenna on KDA-4 Air Inlet Horsecollar.

is drilled for passing the cable from the antenna. The free end of the receiving antenna cable is then passed into the antenna mount, out through the large hole in the mount, and through the 3/4-inch hole just drilled. The receiving antenna is lowered into the mount until the base of the antenna just clears the large hole in the mount (see figure 8b), after which the antenna is secured in place by inserting a set screw into the small hole in the mount and tightening the screw.

Figure 8c represents a view looking into the installed antenna mount prior to placing the antenna into the mount. At the top of figure 9 can be seen the same detail from the opposite side, after the antenna is in place.

After the receiving antenna is secured in its mount, the horsecollar is rebuilt by the application of styrofoam and fiberglass. The empty space is filled with styrofoam, mixed one part Polycel 420 resin to one part Polycel 420 catalyst by weight. When dry, the styrofoam surface is smoothed with a knife, and covered with a piece of cloth of the proper size. Fiberglass, mixed four parts No. 210 catalyst (Hexcel Products) to one part No. 180 hardener (Hexcel Products) by weight, is then applied over the cloth. The cable from the antenna (see figure 9) is connected to a cable which leads to the J601A SIGNAL INPUT jack on the transponder set (see figure 5a).

## DESCRIPTION AND INSTALLATION OF TRANSMITTING ANTENNA

The transmitting antenna is mounted on the ignitor access door (see figure 10). The following section describes the transmitting antenna and gives a procedure for installing it on the ignitor access door and connecting it to the transponder set.

### Transmitting Antenna

The transmitting antenna is a quarter-wave stub using the airframe as a ground plane. This antenna (model AMVT-1B) may be purchased from Aircraft Armaments Incorporated or made according to the dimensions shown in figure 11. If it is inconvenient to construct it with a taper, the antenna may be made with an average diameter of 3/16 inch; a notch should be made near the base to allow antenna breakage rather than fuselage damage when the target impacts on landing.

### Installing Transmitting Antenna

To install the transmitting antenna, eight holes must be drilled in the ignitor access door with a No. 28 drill at the locations indicated by the small screw-head slots seen in figure 12. The antenna is then fastened to the door, after which it is connected with a cable to the J604A SIGNAL OUT jack on the transponder set (see figure 5a).

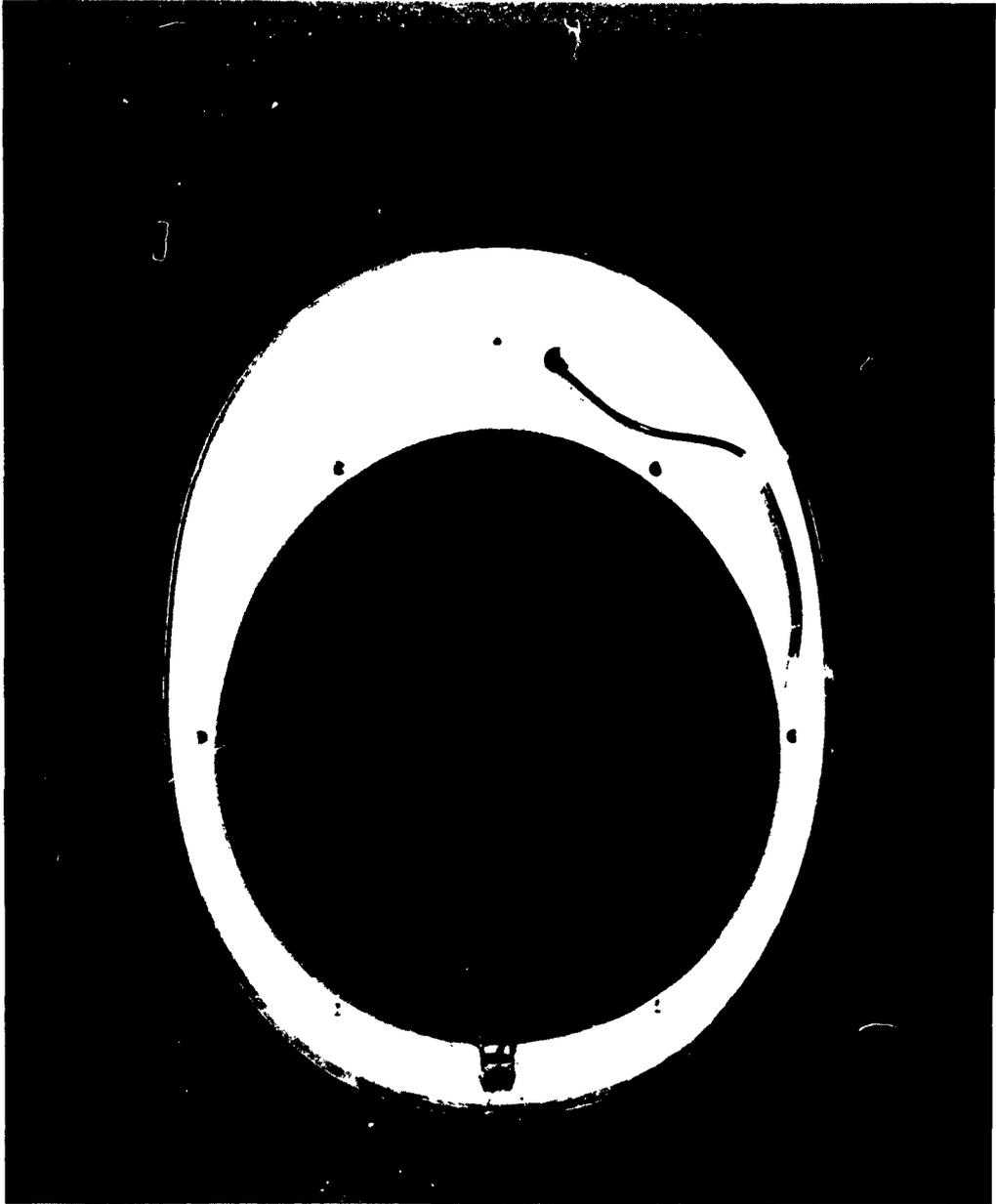


Figure 9. Underside of Air Inlet Horsecollar, Showing Receiving Antenna Installation.



Figure 10. Transmitting Antenna, Installed on Ignitor Access Door.

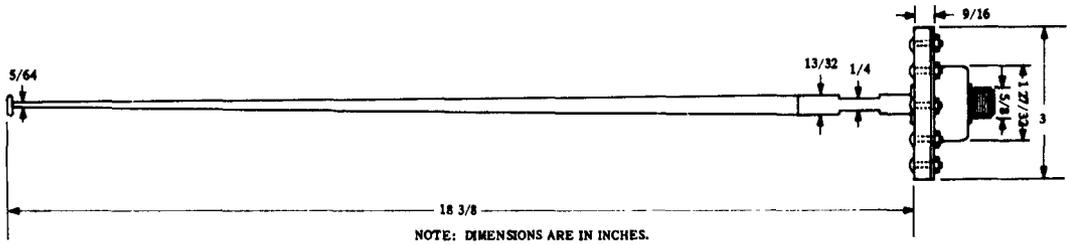
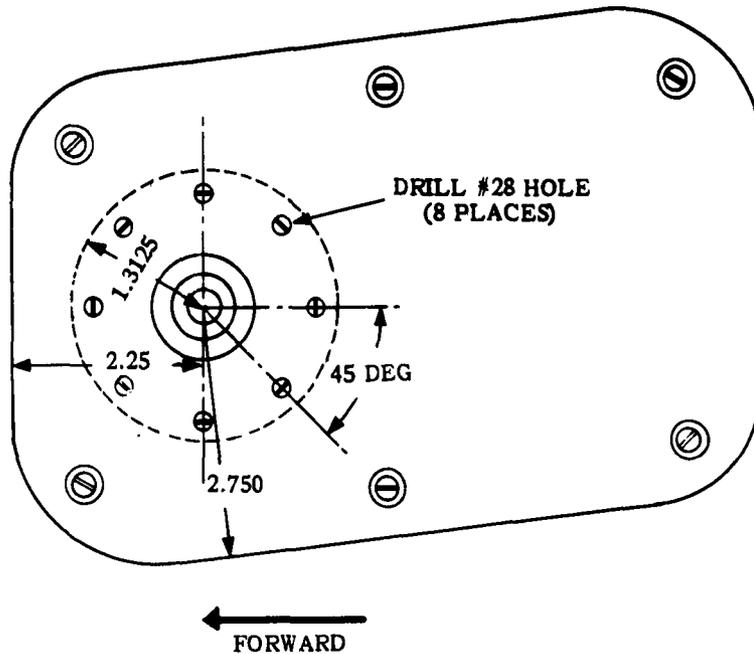


Figure 11. Model AMVT-1B Transmitting Antenna.



NOTE: DIMENSIONS ARE IN INCHES.

Figure 12. KDA-4 Ignitor Access Door, Showing Location of Holes To Be Drilled for Antenna Installation.

## CENTER OF GRAVITY ADJUSTMENT

If no wing pods are installed on the KDA-4 target, installation of the transponder set produces a change in the center of gravity which must be compensated for. This is accomplished by installing 10 pounds of weight in the well below the elevator servo in the tail.